THE PERFORMANCE OF LEGAL INSIDER TRADERS IN PORTUGAL

Joana Isabel Guerra da Fonseca

120417009@fep.up.pt

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Júlio Fernando Seara Sequeira da Mota Lobão

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About the Author

Joana Isabel Guerra da Fonseca was born in Oporto, Portugal on April 19th, 1991.

In 2009 she applied for the bachelor degree in Economics at the Faculty of Economics of the University of Porto where she graduated in the year of 2012.

In the same year, with the purpose of deepening her knowledge and skills, the author joined the Master in Finance in the same institution. This work is the culmination of the two years course program.

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Abstract

Insider trading is a widely discussed subject, relevant for the markets as well as for the regulators, since the informational asymmetries diminish the confidence of outsiders on market fairness and efficiency and may indicate need for further legislation.

Several studies concluded that insiders achieve abnormal returns. In Portugal, Gonçalves and Duque (2008) confirmed this hypothesis, for a period prior to the 2006 law enforcements on insider trading. More recently, Corrêa (2012) evidenced that insiders continue to obtain abnormal returns.

The present study tests the insider trading in NYSE Euronext Lisbon, between January 2008 and December 2013, using the transactions disclosed on CMVM and applying portfolio evaluation measurement and attribution methodologies, as well as the traditional event studies. It is relevant to note that the performance measurement and attribution embody an innovation in terms of the analysis of insiders' performance, as these were not applied in previous studies regarding insider trading in Portugal.

The empirical findings support that insiders outperform the market, achieving abnormal profits and that the greatest market reaction occurs for sales (for an event window of [+1,+20], the purchases exhibit a cumulative abnormal return of 1.16% whilst sales register -2.13%). The portfolio of insider transactions suffered losses of about 39%, against the 65% registered by PSI All-Shares index. Furthermore, the market reaction is still significant after the disclosure date, enabling outsiders to profit by mimicking insider trades and transactions with earlier disclosures are followed by greater market reactions. Additionally, indirect trades (conducted by persons related to the insiders) do not appear to include more information than direct transactions and bank directors do not possess superior capabilities to forecast returns. Finally, the results show that the performance of insiders is mainly attributable to their allocation decisions.

Key-words: Insider Trading; Abnormal Return; Private Information; Portfolio; Performance Measurement; Performance Attribution.

JEL-Codes: G11, G14, G18

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1. Introduction

A simple definition for insider trading is the transaction of company's shares conducted by individuals who have business relationships with that company. Insiders can trade for several purposes. Sometimes insiders trade involuntarily, for example, when they receive stock options to compensate their work in a firm and, if they do not want to increase their exposure relative to the company, they will exercise the option, acquiring the shares, and immediately selling them. Other occasions, insiders trade voluntarily, but whilst some of these trades are legal, others are based on private information, conferring them an advantage over the rest of the market.

But what confers them such an advantage? Well, it is easily understood that those who work in a given company, especially the executives and directors, have more information regarding that company than the rest of the market does, since they know what happens inside the company at each moment. Therefore, they have superior information, leading to the existence of informational asymmetries in the stock market, as they possess superior capability of predicting future stock price movements of their companies. If they decide to use inside information to trade, insiders will achieve abnormal profits while outsiders will suffer abnormal losses.

In Portugal, as in several other countries, insider trading based on private information is illegal. However, Gonçalves and Duque (2008) and Corrêa (2012) concluded that, in spite of the existing legislation, insiders can still achieve abnormal profits.

Since 2008, insider transactions are disclosed on the CMVM website. As a result, outsiders know insiders' trades sooner, instead of having to wait, for example, for corporate annual reports. Even though Corrêa (2012) used this database in his study, the event studies conducted cannot be linearly compared to Gonçalves and Duque (2008) as the event windows are distinct. Moreover, Corrêa (2012) did not conduct event studies across sectors. Additionally, the exclusion of transactions reduced the sample to only 33 companies of the 53 included on the PSI All-Shares index at that time. Furthermore, the relevance of a new study on this subject is justified by the characteristics of the new database, which enable a creation of a portfolio of insider transactions and subsequent application of performance measurement and attribution methodologies.

The present study tests insider trading, using event study, performance measurement and performance attribution methodologies, its patterns on the Portuguese stock market and, as a consequence, concludes on whether there is need for further regulation. Subsequently, the motivation is to test the strong form efficiency since, if insiders achieve abnormal profits, the market is not efficient in the strong form. Accordingly, the study aims to answer to the following questions: Does insider trading continue to exist in Portugal? What are the relevant patterns? Can outsiders profit by copying the insider transactions? Are the results obtained with performance measurement methodologies contrary to the ones attained with event studies? and, Is there need for further legislation on insider trading?

This study contributes to the state of the art through the use of portfolio performance measures to assess the profits earned by insiders, whilst most authors that study insider trading only apply event study methodologies. In fact, performance measurement and attribution methodologies were never used to test insider trading in Portugal.

Throughout this study it must be kept present that the period in analysis includes the financial crisis. In effect, the Portuguese market indexes suffered losses in that period and, as a consequence, even if the profits earned by insiders are small, they still exceed the market average.

The remainder of this study is organized as follows. Chapter 2 explains the concept of insider trading, its potential adverse impacts, some worldwide studies on the effects of the introduction and enforcement of the insider trading laws and the legislation in Portugal. Following, chapter 3 presents the literature review and chapter 4 describes the methodological considerations of the study, that is, the methodologies used. Chapter 5 illustrates the collection of data and the sample creation. Subsequently, chapter 6 exhibits the results attained with event studies, as well as the creation of a portfolio of insider transactions and the findings with performance measurement and attribution methodologies. Finally, chapter 7 concludes.

2. Concept and Legislation

This chapter presents the concept of insider trading, as well as the importance of legislation on this subject and the current legislation in Portugal.

2.1. Concept

It is important to distinguish legal from illegal insider trading. Legal insider trading refers to transactions made by insiders, based on public information. In fact, this form of insider trading must be allowed as it is a form of compensation for executives. As said by Friederich *et al.* (2002, p. 8), "there is nothing illegal about an insider taking a view that their company is misvalued by the stock market, and trading on that basis, provided that the insider does not trade on short term price changes". On the other hand, according to Singal (2003, p. 135) "illegal insider trading refers to trading by insiders on the basis of material and nonpublic information", that is, on information capable of altering stock prices.

According to CMVM, insider trading refers to the notion that insiders, such as managers and directors of publicly traded companies, having access to more information than the remaining investors in the market, can trade based on such inside information. Moreover, "inside information shall mean information of a precise nature which has not been made public relating, directly or indirectly, to one or more issuers, securities or other financial instruments and which, if it were made public, would be likely to have a significant effect on their market" (Portuguese Securities Code (SC), article 378 number 3). The use of such information can affect the market mechanisms, jeopardize operations taking place and even confer non legit advantages to some investors; as a consequence, insider trading is illegal when driven by inside information.

2.2. Importance of Legislation

Insider trading can be viewed as a creator of market efficiency, as a proof of market inefficiency or even as a creator of inefficiency: on one hand, some authors (for instance Carlton and Fischel (1983), Huddart *et al.* (2001) and Inci *et al.* (2010)) defend that insider transactions contribute to the market efficiency by incorporating information on security prices; others state that if insiders achieve abnormal profits then the markets are

not efficient (at least in the strong form) and the last state that insider trading has a negative impact on the efficiency.

The Efficient Market Hypothesis established by Fama (1970) states the three forms of market efficiency: weak, semi-strong and strong form efficiency. Based on their analysis on insider trading, both Finnerty (1976) and Del Brio *et al.* (2002) refuted the strong-form efficiency, whilst Baesel and Stein (1979) found evidence against both the strong and semi-strong form efficiency.

Nevertheless, those who defended the existence of limitations to insider trading state that its existence jeopardizes the efficiency of stock markets. Du and Wei (2004) concluded that countries where insider trading is more common have more volatile stock markets; Fishman and Hagerty (1992) revealed that under specific circumstances insider trading leads to a decrease in the efficiency of stock markets and this happens due to the adverse consequences of insider trading to the competitiveness: outsiders, being aware of the existence of insiders in the market, may deter from acquiring information and trading, so the distribution of information becomes skewed to a single trader, the insider, once he has superior information. Additionally, insider trading widens the market bid-ask spread: one outsider cannot know if the other part of the trade is an insider nor if he is using private information to guide his transaction; as a consequence, outsiders will decrease the price they are willing to purchase at (bid) and increase the price for sales (ask), to balance the losses they might suffer from insider trading, since when an insider earns abnormal profits, an outsider suffers abnormal losses.

Several countries, aware of the potential damage of insider trading on stock markets, created laws to regulate this practice. With it, they attempted to impose rules in order to enhance investor's confidence on the fairness of trading in financial markets (Bhattacharya and Daouk, 2002). Indeed, as documented by Gu and Li (2012) the economic significance of insider trading, measured by quantity and profitability of trades, is negatively related to firms' information transparency. Therefore, laws on insider trading and even on the requirements of information disclosures by listed companies aim at increasing transparency and consequently correcting the market asymmetries associated with inside information.

Empirical studies on the legislation of insider trading revealed that: the introduction of insider trading laws does not affect the cost of equity but the law enforcements reduce it significantly (Bhattacharya and Daouk, 2002; Fernandes and Ferreira, 2009); after the initial enforcement of restrictions to insider trading, analysts following in a country increase, both in terms of intensity of coverage and extent and this increase is stronger in emerging markets (Bushman *et al.*, 2005); in countries with more restrictions to insider trading the use of equity incentives is greater and so are executives' total compensations, and these incentives increase significantly after the initial enforcement of insider trading laws (Denis and Xu, 2013). Moreover, Fernandes and Ferreira (2009) stated that the enforcement of insider trading laws enable an improvement of price informativeness but this effect is greater in developed countries. In emerging markets, especially in those with weak macroeconomic infrastructures, the enforcement of such laws decreases the incorporation of information on prices, thus insider trading laws must be complemented with other policy measures. Accordingly, in these markets it appears that the enforcement of insider trading laws affects the quality of information but not its quantity.

"If inside information is an appropriate form of compensation for certain corporate functionaries, some control of disclosure timing may be necessary to assure that the device is effective" (Manne, 1966). Indeed, several countries' insider trading laws include an obligation for insiders to disclose their transactions (for example, in the United States of America insiders must report to SEC and in Portugal to CMVM). These disclosures enhance the visibility of such transaction to the market, acting as an incentive for insiders to restrain from trading with inside information. Nonetheless, some authors discovered that the disclosures sometimes contain more information than just the characteristics of the trade: insiders exploit their monopoly on information by camouflaging their trades with noise trades on the disclosures and, as a consequence, information held by insiders is incorporated gradually and at a constant rate on prices (Kyle, 1985). Additionally, Huddart *et al.* (2001) found evidence that the disclosure enables a faster incorporation of information on stock prices and reduces insiders' expected profits but there is a dissimulation of insider trades, that is, insiders include

noise trades on their disclosures in order to maximize their expected profits, by hiding their informational advantage from the rest of the market.

2.3. Legislation in Portugal

The Portuguese law prohibits the use and transmission of privileged information before it is made public, with the objective of granting similar conditions of access to the information by distinct investors, having as reference the moment in which the information is announced to the public. In addition, all individuals who have access to private information are prohibited to broadcast it, use it to make transactions or to give advices on transactions (SC, article 378 number 5) and whoever trades based on privileged information should "be punished by a maximum imprisonment of five years or a fine", give back the profits and may be temporarily prohibited from exercising his profession (SC, articles 380, 380-A and 378 number 1).

Additionally, as previously mentioned, CMVM obliges companies to disclose the insider transactions: "Persons discharging managerial responsibilities within an issuer of securities admitted to trading on regulated markets or a company controlling such issuer, as well as any persons closely associated with them, shall notify the CMVM, within five working days, of any transactions made for their own account, for the account of third parties or by third parties for their account in respect of the shares of the relevant issuer or financial instruments related thereto" (SC, article 248-B number 1).

Furthermore, since 2006 the issuers must also disclose a list of insiders, that is, executives, their family, companies they hold and other persons that perform services with the company that have access to inside information.

3. Literature Review

The present chapter illustrates the relevant literature on insider trading, using both event studies and alternative methodologies.

3.1. Relevant Studies

There is a wide literature on insider trading, largely focused on the informational content of insider trades and on the abnormal returns that occur in the market after those trades, hence testing the strong form efficiency. Such interest arises from two perspectives: on one hand, it enables to test the abnormal profits earned by insiders when there is not sufficient information to replicate their portfolios and achieve their real profitability; on the other hand, the persistence of abnormal profits over time allows to assess whether outsiders could profit from mimicking insiders' transactions.

Insiders will achieve abnormal profits if stock prices increase (decrease) after they purchase (sell) shares of their companies. Outsiders will profit when copying insiders if the abnormal profits earned by insiders persist after the disclosure of insider trades – this should not last long since, with the disclosure, the information becomes publicly known and should no longer generate profits as it is included in prices.

Several authors, applied event studies and concluded that insider trading generates abnormal returns. Jaffe (1974) realized that insiders possess and exploit special information, but large transactions do not appear to contain more information than smaller transactions and insiders' profits do not increase with the intensity of trading. Finnerty (1976) also found that insiders can and do indentify profitable as well as unprofitable situations within their corporations. Baesel and Stein (1979) stated that bank directors achieve higher returns in purchases than ordinary insiders, which they believed was due to the first also possessing the information ordinary investors hold. Del Brio *et al.* (2002) agreed that insiders achieve abnormal returns (especially on sales); they also compared direct and indirect transactions (that is, transactions made by insiders and transactions made by family or companies they own) and with this variable they evaluated the effects of the transparency of insider transactions, concluding that when there are indirect transactions the abnormal returns are detected later than in higher transparency transactions. Friederich *et al.* (2002) analyzed trades conducted by

corporate directors and found evidence of short-term market timing, being able to forecast short-term returns. Moreover, the authors realized that medium-size trades contain more information than large-size trades for short-term returns, and purchases achieve more statistically significant abnormal returns than sales. Cheuk *et al.* (2006) exposed that small firms generate the greater and most persistent abnormal profits linked to insider trading, which can persist up to 20 days after the transaction. Fidrmuc *et al.* (2006) studied directors' transactions and concluded on subsequent significant market reactions, especially for purchases, concluding that insiders' transactions contain superior information. Betzer and Theissen (2010) defended that insiders achieve positive abnormal returns and found that the impact of the disclosure speed on the abnormal returns posterior to the disclosure date was not a significant factor, since such returns do not decrease for later disclosures and, subsequently, there is a negative effect on the incorporation of information in prices when disclosures occur later. Degryse *et al.* (2014) concluded that insider trades are information driven and insiders achieve abnormal returns, especially purchases made by top executives and small capitalization firms. Moreover, the authors found evidence of a reduction in the information content on sales by top executives after the implementation of the Market Abuse Directive in 2005.

On the other hand, Aktas *et al.* (2008) defended that insiders do not achieve high abnormal returns.

In Portugal the study by Gonçalves and Duque (2008) found that in spite of the Portuguese legislation, insiders achieve abnormal profits, especially on purchases. Moreover, the abnormal returns are more evident for purchases of companies in the communications sector, with small or medium market capitalization, small Price Book Value (PBV) and Price Earnings Ratio (PER) and high relative trading volume; for sales there is an overall absence of significant negative excess returns, but there are patterns: the issuer is a consumer or industrial company, the firm has large market capitalization, the relative trading volume of the sales is low and the PBV and PER are high.

More recently, Corrêa (2012) used the information regarding insider transactions published in CMVM, for the period ranging from October 2008 to February 2012 and, through the application of the event study methodology the author found evidence that

insiders possess timing abilities as, in accordance with Gonçalves and Duque (2008), insiders' purchases (sales) are followed by positive (negative) abnormal returns. Nevertheless, contrary to the results obtained by Gonçalves and Duque (2008), Corrêa (2012) evidences that the absolute market reaction is greater for sales than for purchases. Furthermore, the abnormal returns are greater in the days following the disclosure of the transaction, in comparison with the ones subsequent to the transaction day, and the market reaction is greater for earlier disclosures. In addition, larger insider holdings are related with higher cumulative abnormal returns, volume is only positively associated to subsequent positive abnormal returns after large volume transactions are excluded and the purchases from small firms generate positive market reactions if the transactions with delayed disclosures are excluded.

The empirical results attained by the previously mentioned authors are summarized in table 1, which evidences, in accordance with Gonçalves and Duque (2008, p. 4), that "There is a common pattern in the literature: insiders' purchases (sales) are typically preceded by negative (positive) abnormal returns before the transaction date and for the event day as well. After the event takes place, the purchases are followed by positive returns while after the sales share prices usually decrease".

Moreover, it is relevant to note that, even though the results exhibited on table 1 consider different samples, periods and stock exchanges, they are coherent on the argument that insiders are capable of predicting stock price movements and, consequently, their transactions outperform the market.

Table 1 - Summary of event study results

This table depicts a summary of the results obtained by the authors referred in the literature review who employed event studies. The first column shows the authors, followed by the sample period, the exchange, the number of firms and transactions included in the study, the number of purchases and sales and finally the event window applicable and the corresponding cumulative abnormal returns. Abbreviations: CRSP (Chicago Research in Security Prices); NYSE (New York Stock Exchange); TSE (Toronto Stock Exchange); VSE (Vancouver Stock Exchange); MSE (Madrid Stock Exchange); SCM (Spanish Continuous Market); LSE (London Stock Exchange); AMEX (American Stock Exchange); ELI (NYSE Euronext Lisbon); FSE (Frankfurt Stock Exchange); EA (NYSE Euronext Amesterdam); OI (Ordinary Insiders); BD (Bank Directors); TE (Top Executives); O (Other Insiders) | Regarding the event windows, Jaffe (1974), Finnerty (1976) and Baesel and Stein (1979) used monthly data whilst the remaining authors employed daily data.

Author(s)	Sample Period	Exchange	No. Firms	No. Transactions	No. Purchases	No. Sales	Event Windows	Cumulative Abnormal Return Aggregated	Purchases	Sales
Jaffe (1974)	1962-68	CRSP	200	952	466	486	[-15,0]	-2.00%	-	-
							[0,+1]	0.60%	-	-
							[0,+2]	1.18%	-	-
							[0,+8]	1.36%	-	-
							[0,+15]	0.50%	-	-
Finnerty (1976)	1969-72	NYSE	-	31,089	9,602	21,487	[0,+1]	-	1.01%	-0.45%
							[0,+2]	-	0.85%	-0.43%
							[0,+3]	-	0.37%	-0.42%
							[0,+6]	-	0.49%	-0.31%
							[0,+11]	-	0.20%	-0.26%
Baesel and Stein (1979)	1968-72	TSE	111	(OI) 580	-	-	[0,+12]	3.80%	-	-
				(BD) 405			[0,+12]	7.80%	-	-
Seyhun (1986)	1975-81	CRSP	769	59,148	24,371	34,777	[-100,0]	-2.10%	-1.40%	2.50%
							[-20,0]	-1.30%	-0.70%	1.70%
							[+1,+20]	1.00%	1.10%	-0.90%
							[+1,+50]	1.60%	1.90%	-1.50%
							[+1,+100]	2.30%	3.00%	-1.70%
Heinkel and Kraus (1987)	1979-81	VSE	132	1,932	-	-	[-19,0]	-	6.22%	10.11%
							[0,+40]	-	10.24%	-4.30%
Del Brio *et al.* (2002)	1992-96	MSE SCM	88	995	589	406	[0,+1]	0.33%	0.13%	0.37%
							[+1,+15]	-0.03%	0.44%	-0.58%
							[+15,+32]	0.29%	0.04%	0.50%
							[+32,+60]	0.60%	0.38%	1.29%
							[+1,+60]	0.80%	0.91%	1.00%
							[-10,+60]	0.97%	-0.09%	3.04%
							[+50,+52]		-0.94%	4.53%
Friederich *et al.* (2002)	1986-94	LSE	196	2970	1,702	1,268	[-20,+20]	-	-0.89%	-0.23%
							[0,+20]	-	1.96%	-1.46%
Jeng *et al.* (2003)	1975-96	NYSE AMEX NASDAQ	-	558,229	208,055	350,174	[0,+5]	-	2.82%	0.79%
							[+5,+21]	-	1.54%	0.08%
							[+21,+180]	-	0.32%	-0.11%
Fidrmuc *et al.* (2006)	1991-98	LSE	1,492	15,663	10,140	5,523	[-20,-1]	-	-2.01%	2.29%
							[0,+1]	-	1.16%	-0.26%
							[0,+4]	-	1.65%	-0.49%
Aktas *et al.* (2008)	1995-99	NYSE AMEX	2,110	59,244	20,023	39,221	[0,+1]	-	0.14%	0.28%
							[0,+4]	-	0.42%	0.23%
Gonçalves and Duque (2008)	2001-05	ELI	28	1,052	667	385	[-5,-1]	-0.75%	-0.18%	1.74%
							[+1,+5]	0.31%	0.35%	-0.25%
							[+1,+10]	0.40%	0.54%	-0.15%
							[+1,+20]	0.76%	0.92%	-0.50%
							[+1,+80]	3.11%	4.25%	-1.14%
Betzer and Theissen (2010)	2002-04	FSE	-	1,977	972	1,005	[0,+20]	3.15%	2.91%	3.37%
Corrêa (2012)	2008-12	ELI	33	738	532	206	[-20,-1]	-	-0.80%	1.66%
							[12,34]	-	-	-2.65%
							[20,38]	-	1.65%	-
							[0,50]	-	1.42%	-2.68%
Degryse *et al.* (2014)	1999-08	EA	149	(TE) 1.244	808	436	[0,+20]	-	1.97%	-1.16%
				(O) 1.683	776	907	[0,+20]	-	0.83%	-2.04%

On the profitability that outsiders can achieve by imitating insider transactions, Cheuk *et al.* (2006) defended that outsiders could achieve abnormal returns, especially when

following insider sales. However, Jaffe (1974) concluded that outsiders could profit with the intensive trades published in the Official Summary, if they knew its content on time, Seyhun (1986) stated that such information is only profitable on the day it is published and Del Brio *et al.* (2002) concluded that outsiders could not achieve profits by copying insiders. Moreover, Friederich *et al.* (2002) adjusted the estimation of abnormal returns to include transaction costs (spread), through the use of daily bid-ask spread in order to assess the profitability for outsiders mimicking insider trades and this change in methodology led to the disappearance of abnormal returns. As a consequence, they concluded outsiders cannot profit from the referred strategies.

In Portugal, according to Gonçalves and Duque (2008), outsiders would be able to profit from copying insiders if the disclosure of transactions was sooner. It is important to note that for the period analyzed by these authors, the information regarding insider transactions was achieved, in general, in the annual reports of the companies but currently that information is available to the public in CMVM website, being that outsiders can obtain such information earlier and, consequently, imitate the insiders' trades earlier. The study conducted by Corrêa (2012), regarding data available in the CMVM website, concludes that outsiders may be able to profit by mimicking insider transactions at least on the 50-day event window (largest event window considered in his study), especially for transactions with earlier disclosures.

3.2. Alternative Methodologies

The majority of literature on insider trading focuses on the event study methodology which estimates equal-weighted average abnormal returns over a fixed period of time following insider trades. Nonetheless, this evaluation is not accurate as the periods of time do not correspond to the actual insiders' holding periods and transaction prices and, as a consequence, the abnormal returns estimated in those studies may be biased. In fact, the option for that methodology is vastly due to the lack of data regarding the details of each insider transaction. Hence, some authors included in their methodology alternatives to event studies.

Heinkel and Kraus (1987) studied insider trading using both event studies and portfolio performance measures, but whilst the first methodology indicated the existence of abnormal profits, the latter did not support superior insider performance, so they

concluded that insiders have some profitable trades but generally they do not outperform outsiders. Eckbo and Smith (1998) analyzed insider transactions in the Oslo Stock Exchange by constructing a portfolio that tracks all insider movements between 1985 and 1992; they "documented zero or negative abnormal performance by insiders" and found that "the average mutual fund outperforms the insider portfolio". Leland (1992), using a rational expectations model and an endogenous investment level realized that the existence of insider trading leads to higher stock prices with greater informational content, an increase in the expected real investment and a decrease in the liquidity of the markets. Furthermore, the author defends that the greater the sensitivity of investment to current price the greater the benefits of insider trading. Lakonishok and Lee (2001) compared the net purchase ration (NPR), as an indicator of insider transactions with the market returns, constructed NPR portfolios and realized that in aggregate insiders are contrarian investors, but their predictive abilities on market movements are better than on contrarian strategies; even more, the predictive power comes from purchases. Tavakoli *et al.* (2012), applying the same methodology as the last authors, found evidence that insiders are capable of predicting future returns, specifically in transactions made by directors and senior management and outsiders can profit from trading strategies that mimic directors' transactions. Jeng *et al.* (2003) constructed insiders' portfolios but due to data limitations they had to use proxy returns from the purchases and sales portfolios; nevertheless, they concluded that insiders' purchases create abnormal returns but sales do not earn significant abnormal returns.

A table presenting a summary of the methodologies employed in the literature can be consulted in annex A.

4. Methodological Aspects

This chapter describes the methodologies used in the present study. Insider trading will be analyzed with event study, performance measurement and performance attribution methodologies. On one hand, the event study method is the most widely used in literature even though, as previously stated, it is not the most correct as it does not regard real holding periods and transaction prices; nevertheless, it was the method employed by Gonçalves and Duque (2008) and in order to enable the comparison of the results obtained in this study with their results, the methodology must be consistent. On the other hand, as almost all the necessary information to construct insiders' portfolios is available on CMVM, it is important to employ alternative methodologies that reflect the transactions more accurately. Additionally, the use of distinct methodologies enables a comparison of the results obtained.

4.1. Event Study

Assuming that an insider will achieve abnormal returns after purchases (sales) whenever the stock prices increase (decrease) abnormally, the test hypothesis is to assess whether abnormal returns are significantly different from zero on the event day, as well as on the following and preceding days.

The abnormal returns of company i at time τ ($AR_{i\tau}$) are achieved by subtracting the expect returns ($E(R_{i\tau}|X_\tau)$) from the actual log returns ($R_{i\tau}$).

$$AR_{i\tau} = R_{i\tau} - E(R_{i\tau}|X_\tau) \tag{4.1}$$

In the context of insider trading, the expectations on the returns of a given stock are dependent on the information detained about the company – if insiders trade with private information, X_τ will include it. In line with the notation by MacKinlay (1997), the event date ($\tau = 0$) corresponds to the date of the insider transaction, the event window ranges between $\tau = T_1 + 1$ and $\tau = T_2$, the estimation window is from $\tau = T_0$ and $\tau = T_1$ and the lengths of the estimation and event windows are respectively $L_1 = T_1 - T_0$ and $L_2 = T_2 - T_1$. The event windows used in this study are those employed by Gonçalves and Duque (2008): [-5,+5], [-5,-1], [+1,+5], [+1,+10], [+1,+20] and [+1,+80]; in addition, the length of the estimation window is 245 trading days.

The expected returns will be estimated recurring to the market model (equation (4.2)) since the advantages of using multifactor models in event studies are limited (MacKinlay, 1997), being that "beyond a simple, one-factor market model, there is no evidence that more complicated methodologies convey any benefit" (Brown and Warner, 1980, p. 249).

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \tag{4.2}$$

The market model considers market wide factors and the systematic risk. For a given security i, R_{it} and R_{mt} are the log returns in period t for the security and for the market portfolio, ε_{it} is the disturbance term and α_i and β_i are parameters of the model. The proxy used for the market portfolio is the PSI All-Shares index (even though it is not truly representative of all investable securities, it is an index of NYSE Euronext Lisbon) and the disturbance of the market model is a proxy for the abnormal return (AR). Considering equation (4.2), equation (4.1) can be rewritten as:

$$AR_{i\tau} = R_{i\tau} - \alpha_i + \beta_i R_{m\tau} \tag{4.3}$$

With the purpose of obtaining overall inferences, the abnormal returns must be aggregated across time and securities. For each event period τ, given N events, the sample aggregated abnormal returns is:

$$\overline{AR}_\tau = \frac{1}{N}\sum_{i=1}^{N} AR_{i\tau} \tag{4.4}$$

The aggregation over the event window yields the cumulative abnormal returns (CAR) for a given event window, which are obtained by:

$$\overline{CAR}_{(\tau_1,\tau_2)} = \sum_{\tau=\tau_1}^{\tau_2} \overline{AR}_\tau \tag{4.5}$$

The statistics to test the null hypothesis are:

$$\theta_1 = \frac{\overline{AR}_\tau}{var(\overline{AR}_\tau)^{1/2}} \sim N(0,1) \tag{4.6}$$

$$\theta_2 = \frac{\overline{CAR}_{(\tau_1,\tau_2)}}{var(\overline{CAR}_{(\tau_1,\tau_2)})^{1/2}} \sim N(0,1) \tag{4.7}$$

"The characteristics of daily data generally present few difficulties in the context of event study methodologies" (Brown and Warner, 1985, p. 25). Still, some problems may arise, such as the non-normality of returns and of excess returns, the bias in OLS estimates of market model parameters in the presence of asynchronous trading and the autocorrelation and heteroskedasticity of daily excess returns. With the exception of the last, Brown and Warner (1985) defended that there are no significant improvements introduced by the use of other procedures rather than OLS. Relative to autocorrelation and heteroskedasticity, tests must be conducted in order to ensure a correct estimation.

Another potential problem is clustering, which occurs when the event windows of the securities overlap and consequently the covariances between the abnormal returns will diverge from zero (MacKinlay, 1997). However, Friederich *et al.* (2002) argue that clustering may not be a relevant limitation when different industries and daily data are used, as the likelihood of events being clustered decreases under such circumstances.

In order to surpass some issues present in event studies, MacKinlay (1997) suggested an aggregation of abnormal returns into a portfolio dated using event time; however Gonçalves and Duque (2008) followed this procedure for the Portuguese stock market, and did not obtain significant differences or improvements on the estimation. Accordingly, this study will employ the traditional event study methodologies.

4.2. Performance Measurement

The performance measurement methodologies described in the present subchapter will be applied to a portfolio of insider transactions, constructed with the information available on CMVM. Additionally, that information will enable the creation of other portfolios: portfolios of insider purchases, of direct and indirect transactions, of bank directors and of ordinary insiders.

4.2.1. Jensen's Alpha

Jensen (1968) developed a model (equation (4.8)) to evaluate the predictive ability of a portfolio manager, that is, his ability of forecasting security prices. Considering a portfolio containing insider trades, Jensen's Alpha can be applied to measure its performance, as insiders can forecast the evolution of security prices of their companies better than the rest of the market if they use private information.

Let R_{pt} be the return of the portfolio on period t, R_{ft} the risk-free rate of return on period t, R_{mt} the return of the market portfolio on period t, u_{pt} the random error that is serially independent, β_p represents the systematic risk and α_p is a constant that represents the average incremental rate of return on the portfolio due to insiders' ability to forecast price movements – if insiders are capable of predicting future price movements, α_p will be positive.

$$R_{pt} - R_{ft} = \alpha_p + \beta_p\left(R_{mt} - R_{ft}\right) + u_{pt} \tag{4.8}$$

According to Grinblatt and Titman (1989), the traditional Jensen measure leads to an upwardly biased estimation of systematic risk for market-timing investment strategies; as a consequence, that measure can assign negative performance to market timers. As the active management of a portfolio induces a variation of the systematic risk through time, Grinblatt and Titman (1989) surpassed that bias by enabling the variation of systematic risk across time (herein referred as GT (1989)):

$$R_{pt} - R_{ft} = \alpha_p + \beta_{pt}\left(R_{mt} - R_{ft}\right) + u_{pt} \tag{4.9}$$

Where $E\left(u_{pt}\right) = 0$ and $\beta_{pt} = \sum_{j=1}^{N} w_{jt} \times \beta_j$ (being w_{jt} the period t portfolio weight on stock j and $B_j = \frac{cov(R_j, R_m)}{var(R_m)}$).

4.2.2. Portfolio Change Measure

Grinblatt and Titman (1993) proposed a Portfolio Change Measure (herein referenced as GT (1993)) without the use of benchmarks:

$$GT = \sum_{t=1}^{T}\sum_{j=1}^{N}\left[R_{jt}\left(w_{jt} - w_{j,t-k}\right)\right]/T \tag{4.10}$$

Where R_{jt} is portfolio return of stock j from day t to $t+1$, w_{jt} and $w_{j,t-k}$ are, respectively, the portfolio weights on stock j at the beginning of the periods t and $t-k$ and T is the number of days. Moreover, k is set as 1 in order to assess the daily changes.

Additionally, this study compares the referred measure with the Event Study Measure (ES):

$$ES = \sum_{t=1}^{T}\sum_{j=1}^{N}\left[w_{jt}\left(R_{jt} - R_{j,t+k}\right)\right]/T \quad (4.11)$$

In the absence of inside information, both measures should converge to zero. Nevertheless, as Grinblatt and Titman (1993, p. 51) pointed out, the GT (1993) measure "has a statistical advantage that derives from its being the average dollar return (i.e., end-of-period value per unit of investment) of a zero-cost portfolio".

4.3. Performance Attribution

With the intent of identifying the source of the returns achieved by insiders, this study will apply the method suggested by Brinson *et al.* (1986, 1991). As a result, the performance attribution methodology will consist on a holdings-based attribution. The active return (AR) of the portfolio is composed by the active asset allocation (allocation effect (AE)), security selection (selection effect (SE)) and the interaction between those effects (interaction effect (IE)):

$$AR = R_p - R_b = \sum_{i=1}^{N}\left[(w_{pi} \times R_{pi}) - (w_{bi} \times R_{bi})\right] \quad (4.12)$$

$$AE = \sum_{i=1}^{N}\left[(w_{pi} \times R_{bi}) - R_b\right] = \sum_{i=1}^{N}\left[(w_{pi} - w_{bi}) \times R_{bi}\right] \quad (4.13)$$

$$SE = \sum_{i=1}^{N}\left[(w_{bi} \times R_{pi}) - R_b\right] = \sum_{i=1}^{N}\left[(R_{pi} - R_{bi}) \times w_{bi}\right] \quad (4.14)$$

$$IE = \sum_{i=1}^{N}\left[(w_{pi} - w_{bi}) \times (R_{pi} - R_{bi})\right] \quad (4.15)$$

Where R_p is the return of the portfolio, R_b is the return of the benchmark, w_{pi} and w_{bi} are, correspondingly, the weights of asset class i in the portfolio and on the benchmark and R_{pi} and R_{bi} are, respectively, the return of asset class i on the portfolio and on the benchmark.

The allocation effect reflects the value from differentiating the assets' allocation from the benchmark, the selection effect expresses gains arising from the selection of

securities that outperform the benchmark and the interaction effect, the residual to achieve the total active return, is the impact of the allocation decisions when the performance of the portfolio diverges from that of the benchmark (Ankrim, 1992; Stewart *et al.*, 2011).

In order to assess the determinants of abnormal profits achieved by insiders, the referred effects will be computed considering the individual securities instead of the asset classes. As a result, the effects will reflect the fact that an insider has inside information on his own company rather than superior information on the asset class or industry sector. Moreover, the benchmark to be considered is the PSI All-Shares index.

5. Sample

The data relative to insider transactions for the period in analysis was collected from the CMVM website. Such information includes the date of the transaction, amount of shares purchased or sold, price of the shares transacted, amount of shares held by the insider after the transaction and whether it is an indirect transaction (this is, a transaction made by the insiders' family or companies owned) or a direct one (transaction made by the insider).

Information regarding insider transactions from 50 companies were available on this database. From those companies, 4 were excluded from the study since their transactions took place in the Spanish stock market.

After that exclusion, 14.584 transactions remained, from which 4 transactions were excluded, as they were disclosed in 2008 but took place in 2006 and 2007, reducing the sample to 14.580 transactions.

Subsequently, all the transactions that were not likely driven by private information were excluded from the sample, similarly to Del Brio *et al.* (2002), Gonçalves and Duque (2008) and Corrêa (2012), as it is evidenced in table 2.

Table 2 - Exclusion of transactions

This table illustrates the exclusion of transactions that were not likely driven by private information, in order to attain the final sample to be analyzed. Specifically, the first column details the reasons for exclusion, the second shows the number of transactions excluded and the third column reveals the remaining number of transactions in the sample.

Types of transactions excluded	Number of transactions excluded	Remaining number of transactions
		14,580
Remuneration plans	451	14,129
Capital changes	65	14,064
Transactions of something other than shares	64	14,000
Mergers and acquisitions	52	13,948
Other transactions	39	13,909
IPO, SPO and public offering of sale	37	13,872
Transactions within entities held by the same insider	28	13,844
Donations	11	13,833

After such exclusion, the final sample contains 46 companies, with a total of 13.833 transactions realized in period ranging from January 2008 to December 2013.

It is relevant to note that the event study methodology may lead to the exclusion of additional transactions in order to conduct the analysis, due to insufficient information both on the event and on the estimation windows. Moreover, the aggregation of transactions by different insiders in the same company will only be made during the event studies. The purpose of aggregating and excluding the transactions only in the scope of the event study methodology arises from the desire to also construct a truthful portfolio of insider trades from this database.

Additionally, the remaining information necessary for this study (stock, indexes (PSI20 and PSI All-Shares) and risk-free asset (30 year German Bonds) prices) were obtained from Datastream.

6. The Performance of Insider Transactions

The present chapter reveals the results obtained with event studies, the creation of a portfolio of insider transactions and the application and findings of performance measurement and attribution methodologies.

6.1. General Results

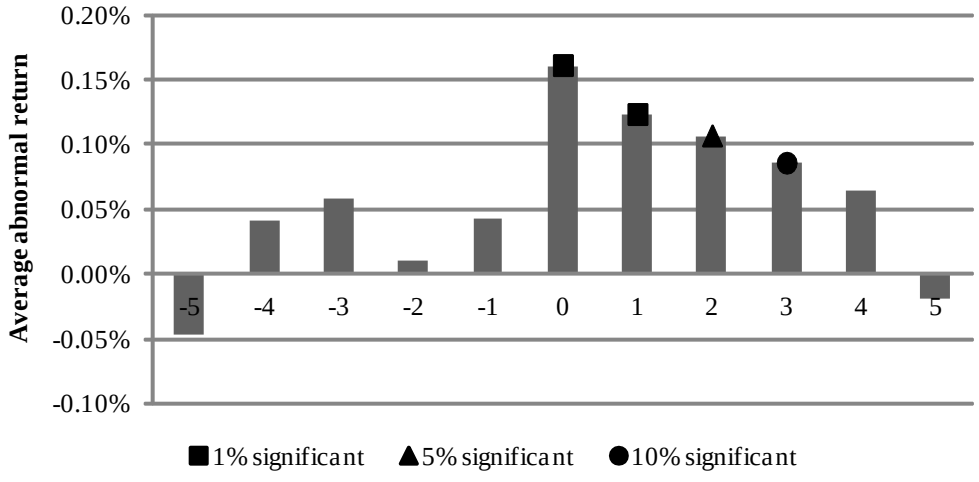
This subchapter depicts the results obtained from the application of the event study methodology to the sample. Moreover, the sample was divided into activity sectors in order to compare their differences in terms of cumulative abnormal returns obtained. Furthermore, the potential profitability for outsiders arising from strategies that mimic insider trades was computed. Finally, the divergences in abnormal returns regarding the transactions' disclosure delay are addressed.

6.1.1. Event Study

Firstly, the event study methodology was applied to the complete sample, including both purchases and sales. Graph 1 illustrates the abnormal return patterns for an event window of [-5,+5], with markers representing the level of significance according to the θ_1 test.

Graph 1 - Average abnormal returns for the event window [-5,+5]

This graph exposes the abnormal returns of the sample (including both purchases and sales) over the event window [-5,+5]. The vertical axis reveals the average abnormal returns whilst the horizontal axis contains the days in the event window. Markers indicate the significance of the average abnormal returns, as detailed in the subtitle. (N= 2959)

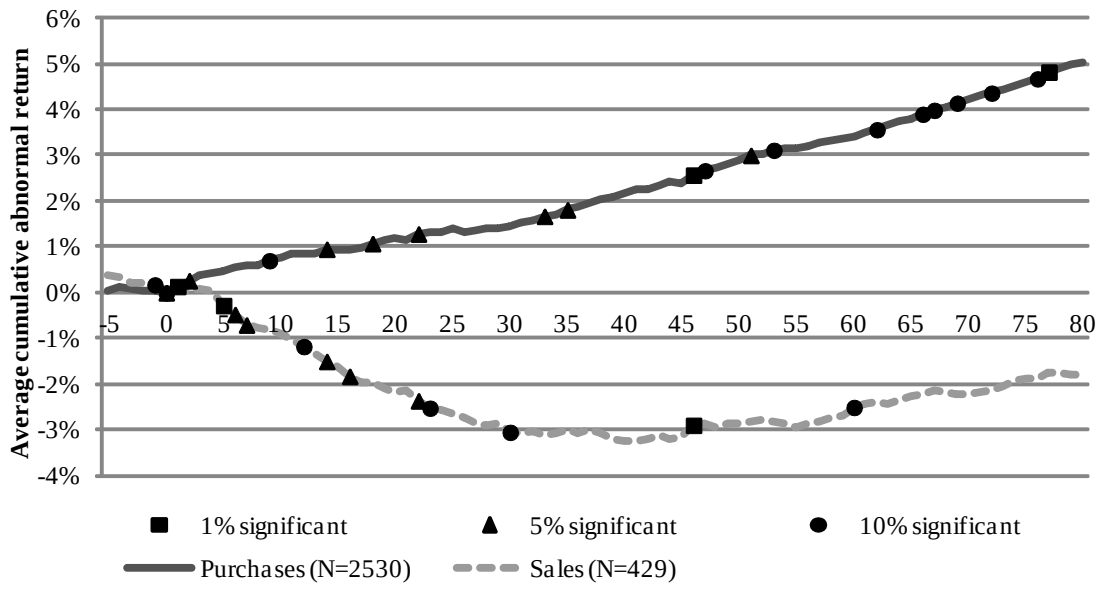


Even though the pattern is not as consistent as the one obtained by Gonçalves and Duque (2008), considering that the aggregation of purchases and sales was made by multiplying the sales by -1, one can still conclude that the abnormal returns on the event day and after the event exceed the ones that can be obtained on the previous days. Therefore, insiders obtain positive abnormal returns on the event day and on the subsequent days.

Graph 2 represents the average cumulative abnormal returns for purchases and sales. The vertical axis indicates the average cumulative abnormal returns, in percentage, given the event windows days portrayed in the horizontal axis. In addition, markers detail the significance according to the θ_2 test. It is relevant to emphasize that both the purchases and sales' curves are normalized to be zero on the transaction day (t=0). With respect to this graph, it is important to note that the average cumulative abnormal returns around the disclosure dates (day 17 and 13, for purchases and sales, respectively) are statistically significant at 5%.

Graph 2 - Average cumulative abnormal returns across the days in the event window

The vertical axis of this graph represents the average cumulative abnormal returns, given the aggregation of all the purchase/sale events for each day of the event window, referenced in the horizontal axis. The purchase and sale curves were normalized so that the average cumulative abnormal return is zero on the event day (t=0). Markers indicate the significance, as detailed in the subtitle.



As mentioned before, in order to analyze the abnormal returns for different time periods, the methodology was applied to several event windows, considering the overall sample, insider purchases and insider sales, as reflected on table 3.

Table 3 - Cumulative abnormal returns for different event windows and samples

This table reveals the average CARs for insider transactions, considering different event windows. The first column indicates the event window, then the results obtained for the overall sample, for the insider purchases and sales are detailed, respectively. The markers ***, ** and * represent the statistical significance at 1%, 5% and 10%, correspondingly.

Event window	Overall sample (N=2959)			Purchases (N=2530)			Sales (N=429)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	0.11%	0.91		0.05%	0.39		0.39%	1.74	*
[-5,+5]	0.63%	3.89	***	0.68%	3.76	***	0.33%	1.01	
Event day [0]	0.16%	2.38	***	0.16%	2.05	**	0.23%	1.89	*
[+1,+5]	0.35%	3.66	***	0.46%	4.38	***	-0.30%	-1.40	
[+1,+10]	0.52%	4.09	***	0.76%	5.51	***	-0.93%	-3.07	***
[+1,+20]	0.68%	3.93	***	1.16%	6.05	***	-2.13%	-5.66	***
[+1,+80]	4.05%	11.63	***	5.02%	13.5	***	-1.83%	-1.95	*

It is important to note that most of the after event results are statistically significant for a 1% significance level, with the exception of the sales sample, that requires higher significance levels. In addition, the pre-event cumulative abnormal returns are only statistically significant in the sales sample and for a 10% significance level.

The empirical findings enable to conclude that, for the overall sample, there are positive cumulative abnormal returns on the days after the event, which exceed the ones previous to the event. Moreover, insider purchases reveal an increase of abnormal returns after the purchase day while sales are preceded by positive abnormal returns and followed by abnormal losses. These results are in line with the conclusions reached by Gonçalves and Duque (2008) and Corrêa (2012), suggesting that insiders' transactions reveal timing ability.

In addition, the linear comparison with the results obtained by Gonçalves and Duque (2008) evidences that regarding the insider purchases, for the same event window, the abnormal returns earned by insiders are greater in the period from 2008 to 2013, in comparison with the ones computed by the afore mentioned authors between 2001 and 2005. Additionally, the market reaction posterior to sales also increased in the years in analysis in this study, compared to the findings by Gonçalves and Duque (2008).

On the market reaction subsequent to the insider transactions, in absolute terms, the sales sample exhibits a greater reaction than the purchases samples, similarly to Corrêa (2012), with the exception of the event window [+1,+80]. Nevertheless, it is relevant to emphasize that the period in analysis is demarked by the financial crisis and, consequently, by overall negative returns, as further detailed in the creation of the portfolio of insider transactions (subchapter 6.2.1.). As a result, even though the sales appear to be followed by greater market reactions than purchases, the conclusion that sales may indicate greater inside information content, contrary to the evidenced by Gonçalves and Duque (2008), may be biased by the financial crisis.

Concluding, insider purchases are typically followed by an increase in stock prices whilst insider sales are followed by a decrease in stock prices and the abnormal profits are more accentuated for insider sales than for insider purchases. Accordingly, in spite of the existing legislation on insider trading in Portugal, insiders are capable of obtaining abnormal profits, which indicates that this phenomenon, firstly detected in Portugal by Gonçalves and Duque (2008) for the years comprised between 2001 and 2005, continued to exist from 2008 to 2013.

6.1.2. Differences across Sectors

In order to assess the divergences across the activity sectors, a characteristics analysis was conducted, dividing the transactions by sectors, as illustrated in table 4.

As evidenced in that table, the telecommunications, consumer goods and industrials sectors exhibit statistically significant results for purchases in all event windows posterior to the event day, in contrast to Gonçalves and Duque (2008) that only recorded such significance for the communications sector. In fact, regarding the former enunciated sectors, they show positive cumulative abnormal returns after insider purchases. On the other hand, the oil and gas and the basic materials sectors indicate that their insiders have return predictive abilities on sales.

The financial sector does not exhibit statistically significant returns in most event windows, even though it reveals a significant positive abnormal return, for purchases, given an event window of [+1,+80]. With exception of the referred event window, from the attained results one cannot conclude, globally, that bank directors possess more

information than ordinary insiders, in contrast with the findings of Baesel and Stein (1979). Nevertheless, in contrast with Gonçalves and Duque (2008), they do not exhibit the worst cumulative abnormal returns amongst the sectors analyzed.

Table 4 - Cumulative abnormal returns per sector of activity

This table reveals the average CARs for insider transactions divided per sector of activity, considering different event windows. The panels A to I show the results attained for each sector. The first column indicates the event window, then the results obtained for the overall sample, for the insider purchases and sales are detailed, respectively. The markers ***, ** and * represent the statistical significance at 1%, 5% and 10%, correspondingly.

Panel A - Oil and Gas

Event window	Overall sample (N=13)			Purchases (N=9)			Sales (N=4)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	-3.58%	-1.75		-5.62%	-2.10	*	1.00%	0.99	
[-5,+5]	-4.14%	-1.58		-5.12%	-1.35		-1.94%	-3.18	**
Event day [0]	-0.84%	-1.55		-1.31%	-2.03	*	0.22%	0.25	
[+1,+5]	0.34%	0.28		1.89%	1.27		-3.13%	-22.46	***
[+1,+10]	-2.46%	-1.24		-2.14%	-0.76		-3.15%	-2.16	
[+1,+20]	-1.64%	-0.69		-0.65%	-0.19		-3.87%	-4.14	**
[+1,+80]	-6.58%	-1.99	*	-1.86%	-0.54		-17.22%	-4.02	**

Panel B - Basic Materials

Event window	Overall sample (N=178)			Purchases (N=135)			Sales (N=43)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	-0.07%	-0.23		0.57%	1.76	*	-2.09%	-3.82	***
[-5,+5]	-0.63%	-1.43		0.68%	1.49		-4.73%	-5.27	***
Event day [0]	-0.03%	-0.21		0.20%	1.19		-0.78%	-2.05	**
[+1,+5]	-0.53%	-1.93	*	-0.14%	-0.49		-1.77%	-2.50	**
[+1,+10]	-1.10%	-3.27	***	-0.26%	-0.78		-3.72%	-4.69	***
[+1,+20]	-2.47%	-4.88	***	-0.48%	-1.00		-8.74%	-8.95	***
[+1,+80]	-0.53%	-0.36		0.55%	0.59		-3.94%	-0.73	

Panel C - Industrials

Event window	Overall sample (N=960)			Purchases (N=794)			Sales (N=166)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	0.38%	2.32	**	0.28%	1.49		0.88%	2.63	***
[-5,+5]	1.05%	4.39	***	1.05%	3.85	***	1.05%	2.25	**
Event day [0]	0.15%	1.49		0.13%	1.10		0.24%	1.61	
[+1,+5]	0.50%	3.14	***	0.63%	3.52	***	-0.13%	-0.39	
[+1,+10]	0.69%	3.04	***	0.97%	3.86	***	-0.60%	-1.11	
[+1,+20]	1.26%	4.20	***	1.81%	5.33	***	-1.36%	-2.36	**
[+1,+80]	5.71%	10.17	***	7.34%	11.90	***	-2.05%	-1.72	*

Panel D - Consumer Goods

Event window	Overall sample (N=36)			Purchases (N=35)			Sales (N=1)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	-0.31%	-0.13		-1.06%	-0.45		25.93%	0.60	
[-5,+5]	4.39%	1.85	*	3.55%	1.55		33.78%	0.68	
Event day [0]	0.77%	0.92		1.31%	1.99	*	-18.06%	0.68	
[+1,+5]	3.95%	2.82	***	3.34%	2.57	**	25.27%	1.31	
[+1,+10]	3.76%	2.17	**	3.00%	1.88	*	30.42%	1.50	
[+1,+20]	8.07%	2.11	**	7.68%	1.96	*	21.91%	0.86	
[+1,+80]	8.52%	2.64	**	8.14%	2.46	**	21.75%	0.40	

Panel E - Consumer Services

Event window	Overall sample (N=813)			Purchases (N=777)			Sales (N=36)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	0.43%	2.07	**	0.38%	1.78	*	1.53%	1.65	
[-5,+5]	1.05%	3.61	***	0.97%	3.28	***	2.78%	1.76	*
Event day [0]	0.31%	2.67	***	0.29%	2.45	**	0.64%	1.54	
[+1,+5]	0.30%	1.38		0.28%	1.29		0.57%	0.56	
[+1,+10]	0.72%	2.68	***	0.73%	2.62	***	0.49%	0.61	
[+1,+20]	0.66%	1.82	*	0.74%	1.99	**	-1.22%	-1.13	
[+1,+80]	1.73%	2.35	**	2.18%	2.87	***	-7.90%	-3.31	***

Panel F - Telecommunications

Event window	Overall sample (N=146)			Purchases (N=88)			Sales (N=58)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	0.93%	3.01	***	1.39%	3.34	***	0.23%	0.53	
[-5,+5]	1.69%	3.65	***	2.84%	4.96	***	-0.07%	-0.10	
Event day [0]	0.21%	1.32		0.15%	0.97		0.29%	0.91	
[+1,+5]	0.51%	1.53		1.26%	2.99	***	-0.62%	-1.18	
[+1,+10]	1.18%	2.52	**	2.32%	3.87	***	-0.55%	-0.78	
[+1,+20]	0.97%	1.62		2.07%	2.65	***	-0.70%	-0.77	
[+1,+80]	10.42%	5.77	***	15.14%	5.52	***	3.28%	2.32	**

Panel G - Utilities

Event window	Overall sample (N=318)			Purchases (N=290)			Sales (N=28)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	-0.12%	-0.74		-0.07%	-0.39		-0.63%	-1.59	
[-5,+5]	0.23%	1.05		0.38%	1.64		-1.33%	-2.23	**
Event day [0]	-0.06%	-0.64		-0.07%	-0.70		0.06%	0.37	
[+1,+5]	0.43%	2.75	***	0.54%	3.27	***	-0.75%	-2.04	*
[+1,+10]	0.65%	3.03	***	0.93%	4.21	***	-2.23%	-3.38	***
[+1,+20]	1.26%	4.22	***	1.56%	4.93	***	-1.85%	-3.24	***
[+1,+80]	2.09%	2.89	***	2.30%	3.02	***	-0.50%	-0.25	

Panel H - Financials

Event window	Overall sample (N=316)			Purchases (N=232)			Sales (N=84)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	-1.66%	-2.57	**	-2.39%	-2.79	***	0.39%	0.67	
[-5,+5]	-1.81%	-2.09	**	-2.95%	-2.63	***	1.15%	1.42	
Event day [0]	-0.05%	-0.13		-0.46%	-0.86		0.79%	2.40	**
[+1,+5]	-0.10%	-0.33		-0.10%	-0.27		-0.03%	-0.07	
[+1,+10]	-0.37%	-0.89		-0.20%	-0.39		-0.78%	-1.17	
[+1,+20]	-0.18%	-0.33		0.40%	0.62		-1.80%	-1.70	*
[+1,+80]	7.15%	6.11	***	9.69%	7.61	***	0.41%	0.17	

Panel I - Technology

Event window	Overall sample (N=179)			Purchases (N=170)			Sales (N=9)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	0.48%	0.95		0.50%	0.93		0.16%	0.17	
[-5,+5]	1.55%	2.03	**	1.62%	2.03	**	0.16%	0.14	
Event day [0]	0.55%	1.91	*	0.58%	1.90	*	0.03%	0.11	
[+1,+5]	0.48%	1.13		0.51%	1.14		-0.05%	-0.09	
[+1,+10]	0.53%	1.01		0.60%	1.11		-0.93%	-1.24	
[+1,+20]	-0.13%	-0.18		-0.03%	-0.04		-2.09%	-1.33	
[+1,+80]	2.79%	2.31	**	3.54%	2.86	***	-11.50%	-4.29	***

6.1.3. Profitability for Outsiders

Another relevant question is whether outsiders can earn abnormal profits with trading strategies that imitate insider trades. The information available on CMVM indicates that, on average, the disclosures are released in less than 21 days after the transaction date. Taking in consideration the average disclosure period and the abnormal profits exhibited on table 3 relative to the event window [+1,+80] (which exceed the abnormal returns that can be obtained in smaller event windows), the outsiders can profit from strategies that follow insider transactions.

However, in order to enable a more accurate analysis on the profitability of the outsiders, an event study analysis was executed using the disclosure date instead of the transaction date. This enables the study of the cumulative abnormal returns that occur after the public disclosure of the information regarding the insiders' transactions and, subsequently, compute the abnormal returns that outsiders can obtain by imitating insider transactions on the day the disclosure is made. In addition, the comparison of the outcomes from this study with the ones previously mentioned concerning the transaction date emphasizes the market reactions and profitability after the disclosure.

As illustrated in table 5, the purchases (sales) are followed by positive (negative) cumulative abnormal returns. Consequently, in accordance with the findings of Corrêa (2012), an outsider can profit from a strategy of imitating insider transactions.

Furthermore, the market reaction is greater, in absolute terms, 20 days after the disclosure (table 5) in comparison with the market reaction after the transaction date (table 3). In addition, similarly to the analysis of market reactions around the transaction day, the sales have more significant absolute cumulative abnormal returns, suggesting a greater content of information.

Table 5 - Cumulative abnormal returns around the disclosure day

This table reveals the average CARs for insider transactions, considering the disclosure day as the event day, for different event windows. The first column indicates the event window, then the results obtained for the overall sample, for the insider purchases and sales are detailed, respectively. The markers ***, ** and * represent the statistical significance at 1%, 5% and 10%, correspondingly.

Event window	Overall sample (N=931)			Purchases (N=741)			Sales (N=190)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	0.24%	1.10		0.17%	0.64		0.54%	1.61	
[-5,+5]	0.30%	1.05		0.50%	1.49		-0.49%	-0.94	
Event day [0]	-0.04%	-0.45		-0.06%	-0.71		0.05%	0.33	
[+1,+5]	0.07%	0.42		0.37%	1.97	**	-1.09%	-2.74	***
[+1,+10]	0.26%	1.16		0.69%	2.76	***	-1.41%	-3.07	***
[+1,+20]	0.53%	1.64	*	1.31%	3.53	***	-2.50%	-4.13	***

6.1.4. Disclosure Speed

As previously referred, the Portuguese law states that insiders must disclose the transactions within 5 working days to CMVM. However, the sample in analysis shows that disclosures, on average, are made more than 15 working days after the transaction day (16.82 days for purchases and 13 days for sales). This divergence from the legal reporting period rises the question whether insider trades disclosed within 5 working days contain more or less information than transactions which disclosure occurs after 5 working days. Corrêa (2012) analyzed this subject and found evidence, regarding the sample of insider purchases, that the sooner the disclosure, the greater the cumulative abnormal returns for an event window of [0,+10], whilst for sales sample there were not significant deviations.

In order to provide a linear comparison between the abnormal returns achieved by transactions disclosed within 5 working days and the remaining transactions, event

studies were conducted regarding this division. As shown in table 6, the differences between the cumulative abnormal returns on panel A and B widen the conclusions made by Corrêa (2012) regarding the purchases sample to all samples: insiders' transactions with earlier disclosures are followed by greater market impacts. Nonetheless, the subsequent market impact can be attributable either to trades with more significant informational content or to outsiders trading in the same direction seeking to profit, as they may attribute more importance to these disclosures.

Table 6 - Cumulative abnormal returns depending on the disclosure speed

This table reveals the average CARs for insider transactions, considering the number of trading days between the transaction and the disclosure dates. Panel A depicts the results for transactions which disclosures were made after the legal limit, whilst Panel B shows the results for disclosures within 5 working days. The first column indicates the event window, then the results obtained for the overall sample, for the insider purchases and sales are detailed, respectively. The markers ***, ** and * represent the statistical significance at 1%, 5% and 10%, correspondingly.

Panel A - Disclosures exceeding 5 working days

Event window	Overall sample (N=1581)			Purchases (N=1375)			Sales (N=206)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	0.16%	1.18		0.09%	0.62		0.62%	1.75	*
[-5,+5]	0.60%	3.00	***	0.51%	2.38	**	1.15%	2.18	**
Event day [0]	0.03%	0.26		0.01%	0.07		0.16%	0.99	
[+1,+5]	0.40%	3.16	***	0.41%	2.99	***	0.34%	0.96	
[+1,+10]	0.48%	2.74	***	0.62%	3.32	***	-0.46%	-0.91	
[+1,+20]	0.33%	1.39		0.59%	2.32	**	-1.49%	-2.61	***
[+1,+80]	1.46%	3.20	***	1.82%	3.74	***	-0.94%	-0.70	

Panel B - Disclosures within 5 working days

Event window	Overall sample (N=1423)			Purchases (N=1191)			Sales (N=232)		
	CAR	Test θ_2		CAR	Test θ_2		CAR	Test θ_2	
[-5,-1]	-0.06%	-0.32		-0.09%	-0.41		0.12%	0.44	
[-5,+5]	0.52%	2.03	**	0.72%	2.43	**	-0.38%	-1.00	
Event day [0]	0.30%	4.41		0.32%	4.12	***	0.34%	1.94	*
[+1,+5]	0.26%	1.86	*	0.48%	2.98	***	-0.86%	-3.49	***
[+1,+10]	0.56%	3.14	***	0.95%	4.73	***	-1.40%	-4.13	***
[+1,+20]	1.14%	4.40	***	1.93%	6.71	***	-2.92%	-6.01	***
[+1,+80]	7.04%	13.82	***	8.92%	16.52	***	-2.67%	-2.11	**

6.2. Performance Measurement Results

As previously noted, event studies do not take into account the real holding periods. Consequently, the creation of a portfolio of insider transactions and the use of performance measurement methodologies enable a more accurate test on whether insiders achieve abnormal profits.

The present section will depict the creation of a portfolio which aggregates the insider transactions in analysis, as well as a direct comparison between the returns attained by that portfolio and the returns achieved by the Portuguese market indexes (PSI All-Shares and PSI20). Subsequently, the results deriving from the application of the portfolio measurement methodologies to this portfolio of insider transaction will be exhibited.

Even though that, according to event studies' results, insider sales have a greater impact on the market than insider purchases, which can be attributable to greater information content, a portfolio of insider purchases will be created in order to examine the returns of a buy and hold strategy, with purchases aligned with the insider acquisitions.

Finally, in order to assess the differences in terms of returns obtained between direct and indirect transactions and bank directors and ordinary insiders, the portfolio is divided among these groups and the results from the application of the methodologies are detailed.

6.2.1. Portfolio Creation

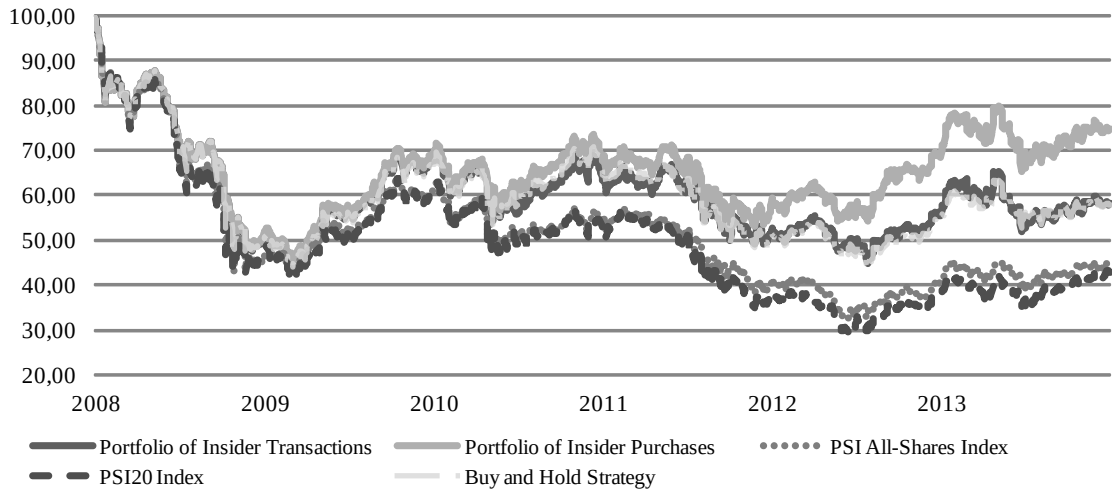
In order to apply performance measurement methodologies, a portfolio of insider transactions was created. This portfolio considers the initial amount of transactions held by the insiders and the transactions' outcomes (money earned from sales or spent with purchases) were computed with the real prices and amounts of the transactions. Additionally, the portfolio is updated daily, thus reflecting the real holding periods of the insiders. Moreover, as the portfolio results from the aggregation of the insider trades, it includes all the individual information regarding each company.

Accordingly, this portfolio reflects more accurately the evolution of insider trades in the period in analysis and the application of performance measurement methodologies to this portfolio can yield more truthful results in comparison with the event study methodology since, as previously referred, the latter does not regard real insiders' holding periods or transaction prices (which can bias the conclusions made with the estimates of abnormal returns) whilst the former considers real holding periods, transaction prices and quantities.

Graph 3 illustrates the evolution of the portfolio value throughout the period in analysis, considering a base of 100, altering with the daily returns. Such graph enables to conclude that the portfolio value had an overall decrease in value between 2008 and 2013, which is not shocking considering the financial crisis. In addition, a graph illustrating the evolution of the returns attained by the portfolio, in percentage, is exhibited in annex B.

Graph 3 - Evolution of the portfolio value (base of 100 at January 2008)

This graph depicts the evolution of the value of the portfolios of insider transactions and of insider purchases, of the buy and hold strategy and of the PSI all-shares and PSI20 indexes, considering a base of 100 which alters with the daily returns, throughout the period comprised between January 2008 and December 2013. The vertical axis represents the value of the portfolio with a base of 100 and the horizontal axis represents the timeline.



In the period from 2008 to 2013, the portfolio registered an overall return of -39.34%, whilst the portfolio of insider purchases achieved and overall return of -14.81%. The portfolio of insider purchases was created in the same manner as the portfolio of insider transactions, but it ignores the sales made in the period in study. The comparison between these portfolios enables to conclude that if insiders had only purchased shares and held them until the end of 2013, they would have suffered inferior losses. On the other hand, a buy and hold strategy, considering the amount of shares owned in the beginning of 2008, would yield a return of -40.15% between 2008 and 2013. As a result, the portfolio containing only the insider purchases had the smallest loss throughout the period in analysis (of 14.81%), followed by the portfolio of insider transactions (the inclusion of insider sales increases the loss to 39.34%), whilst the buy

and hold strategy had the worst performance (acquiring the shares in the beginning of 2008 and holding those positions until the end of 2013 yielded a loss of 40.15%).

Nonetheless, it is crucial to notice that the period in analysis includes the years of the financial crisis, which can potentially bias the study as during such periods the financial market reflects unusual behaviors. In fact, for the same period, the returns of the PSI All-Shares and of the PSI20 indexes were, respectively, of -65.23% and -68.56%. The simple comparison of the returns enables to conclude that the losses suffered by insiders were less severe than the ones incurred by the market, that is, the inherent to a passive strategy. Table 7 illustrates the mentioned returns obtained by the market indexes, by a buy and hold strategy and by the portfolios of insider transactions and of insider purchases, between 2008 and 2013. Additionally, a graph of the overall returns detailed in table 7 is shown in annex C.

Table 7 – Market, buy and hold strategy and portfolios' returns between 2008 and 2013

This table details the returns obtained by the Portuguese market indexes, by a buy and hold strategy, by the portfolio of insider transactions and by the portfolio of insider purchases between 2008 and 2013, as well as the overall returns. The buy and hold strategy reflects the returns deriving from acquiring the shares in the beginning of 2008 and holding those positions until the end of 2013, the portfolio of insider transactions contains all transactions in the sample and the portfolio of insider purchases excludes insider sales.

	PSI All-Shares Index	PSI20 Index	Buy and Hold Strategy	Portfolio of Insider Transactions	Portfolio of Insider Purchases
2008	-71.91%	-71.94%	-64.13%	-62.92%	-61.80%
2009	29.90%	28.87%	29.92%	30.14%	30.78%
2010	-10.64%	-10.92%	-0.70%	-4.06%	0.67%
2011	-26.53%	-32.29%	-21.79%	-18.31%	-12.87%
2012	2.79%	2.89%	7.18%	9.05%	18.24%
2013	11.17%	14.82%	9.37%	6.76%	10.17%
Overall	-65.23%	-68.56%	-40.15%	-39.34%	-14.81%

6.2.2. Portfolios of Insider Transactions and of Insider Purchases

Table 8 reveals the empirical results of the application of the performance measurement methodologies to the portfolios of insider transactions and of insider purchases. In Panel A the results for Jensen's Alpha and GT (1989) are detailed. In fact, the alpha is positive for both portfolios, indicating that insiders are capable of predicting stock price changes. Nevertheless, these results are not statistically significant for the portfolio of insider transactions at a significance level of 10%. On the other hand, the results for the portfolio of insider purchases exhibit a greater alpha and the results have statistical significance at 5%.

Panel B from table 8 details the findings deriving from the application of the GT (1993) and ES measures. Such results are expected to converge to zero in the absence of superior information. Even though the values do not diverge significantly from zero, for both portfolios, they exceed that value, suggesting the existence of privileged information.

Table 8 - Results for Jensen's Alpha, GT (1989), GT (1993) and ES

This table exhibits the results attained for the portfolios of insider transactions and of insider purchases. Panel A shows the outcome from the use of Jensen's Alpha and GT (1989) methodologies, while Panel B reveals the values of the GT (1993) and ES measures. The markers ***, ** and * represent the statistical significance at 1%, 5% and 10%, correspondingly. (N=1566)

Panel A

Portfolio	Jensen's Alpha			GT (1989)		
	Alpha	T-statistic		Alpha	T-statistic	
Insider transactions	0,012%	0,87		0,009%	0,69	
Insider purchases	0,027%	2,16	**	0,025%	1,98	**

Panel B

Portfolio	GT (1993)	ES
Insider transactions	0,02896%	0,02858%
Insider purchases	0,02873%	0,02834%

In summary, the application of Jensen's Alpha indicates superior information in insider trades, even though it is not statistically significant for the portfolio of insider transactions. With respect to the GT (1993) measure, the average euro return of a zero cost portfolio is of about 0.03% in both cases, which is relevant considering the market decline verified in the period in analysis. It is important to note that this result does not diverge from the findings in the event study methodology.

In accordance with Eckbo and Smith (1998), the results of the portfolio of insider transactions exhibited in Panel A are not statistically significant. Moreover, similarly to the study conducted by the mentioned authors, the application of the GT (1989) methodology (which allows betas to be time-varying) yields smaller estimates of alpha. This decrease is also verified in the portfolio of insider purchases.

Nonetheless, Eckbo and Smith (1998) did not find evidence of abnormal returns using performance measurement methodologies, whilst this study does.

6.2.3. Portfolios of Direct and Indirect Transactions

As Del Brio *et al.* (2002) noted, indirect transactions, this is, transactions made by those related to the insider are used to conceal the use of privileged information.

In order to test whether indirect transactions achieve superior returns relative to the direct transactions, the portfolio was divided in two: the direct transactions and the indirect transactions portfolios. The construction of the portfolio of direct (indirect) transactions assumes that only the direct (indirect) transactions take place and that those related to the insiders (the insiders) hold their shares throughout the period.

The application of the performance measure methodologies yields the results exhibited in table 9.

Table 9 - Results for Jensen's Alpha, GT (1989), GT (1993) and ES applied to portfolios of direct and indirect transactions

This table exhibits the results attained for the portfolios of direct and indirect transactions. Panel A shows the outcome from the use of Jensen's Alpha and GT (1989) methodologies, while Panel B reveals the values of the GT (1993) and ES measures. The markers ***, ** and * represent the statistical significance at 1%, 5% and 10%, correspondingly. (N=1566)

Panel A

Portfolio	Jensen's Alpha		GT (1989)	
	Alpha	T-statistic	Alpha	T-statistic
Direct transactions	0,009%	0,64	0,007%	0,50
Indirect transactions	0,014%	1,07	0,012%	0,89

Panel B

Portfolio	GT (1993)	ES
Direct transactions	0,02881%	0,02843%
Indirect transactions	0,02865%	0,02826%

As shown in table 9, all methodologies indicate that in the studied portfolios insiders achieve profits. However, whilst the methodologies in Panel A reveal that indirect transactions include superior capabilities to forecast price movements in comparison with direct transactions, the GT (1993) and ES measures in Panel B yield similar results for both portfolios. Moreover, the results in Panel A are not statistically significant, similarly to the conclusions made for the portfolio of insider transactions. Therefore, for

the market in analysis and for the period considered, it cannot be concluded that indirect transactions include more privileged information than direct transactions.

6.2.4. Portfolios of Bank Directors and Ordinary Insiders

Similarly to Baesel and Stein (1979), this study divided the portfolio in order to examine separately the returns obtained by bank directors (insiders of financial companies) in contrast with ordinary insiders.

Even though, as concluded by Baesel and Stein (1979), it is expected for bank directors to have more information than ordinary insiders and accordingly to obtain higher profits, as represented in table 10, both methodologies attribute higher returns to ordinary insiders. As a result, bank directors do not appear to have more privileged information than the rest of the market. This conclusion is in accordance with the results obtained with the application of the event study methodology, in which there are sectors that achieve higher and more significant cumulative abnormal returns than the financial sector (table 4).

Table 10 - Results for Jensen's Alpha, GT (1989), GT (1993) and ES applied to portfolios of bank directors and ordinary insiders

This table exhibits the results attained for the portfolios of bank directors and ordinary insiders. Panel A shows the outcome from the use of Jensen's Alpha and GT (1989) methodologies, while Panel B reveals the values of the GT (1993) and ES measures. The markers ***, ** and * represent the statistical significance at 1%, 5% and 10%, correspondingly. (N=1566)

Panel A

Portfolio	Jensen's Alpha			GT (1989)	
	Alpha	T-statistic		Alpha	T-statistic
Bank directors	-0,039%	-0,80		-0,041%	-0,82
Ordinary insiders	0,029%	1,78	*	0,024%	1,52

Panel B

Portfolio	GT (1993)	ES
Bank directors	0,01814%	0,01764%
Ordinary insiders	0,02634%	0,02602%

6.3. Performance Attribution Results

The performance attribution analysis for the portfolio of insider transactions, evaluated on a yearly basis, enabled to conclude that insiders have an overall positive total active

return that exceeds 20%. This result supports the conclusions on the previous methodologies that insiders outperform the market. Additionally, the allocation effect exceeds the selection effect, indicating that the profits are mainly due to the differences on allocation choices relative to the benchmark. The outcome of this methodology is exhibited on table 11 and the evolution is illustrated in annex D.

Table 11 - Performance attribution results

This table reveals the findings obtained by the performance attribution analysis of the portfolio of insider transactions. First, the yearly results are shown, followed by the overall outcome. The abbreviation AE, SE, IE and AR denote, respectively, Allocation Effect, Selection Effect, Interaction Effect and Active Return.

Performance Attribution							
	2008	2009	2010	2011	2012	2013	Overall
AE	2.23%	0.97%	13.11%	6.29%	9.61%	-0.65%	17.81%
SE	1.29%	-0.19%	0.69%	7.99%	7.13%	-2.11%	8.50%
IE	0.02%	0.69%	-3.36%	-4.45%	-4.96%	-0.32%	-5.49%
AR	3.53%	1.46%	10.44%	9.83%	11.79%	-3.09%	20.82%

In fact, there is a reason for the excess of the allocation effect over the selection effect: the period in analysis includes the financial crisis, in which the market exhibited overall losses. As a consequence, the creation of value does not arise from selecting securities that outperform the market since the portfolio includes most securities that compose the market indexes. In effect, the value derives from exploiting moments in which a given security yields returns, that is, purchase it before the price increases and selling it prior to price declines. These trades will imply a different asset allocation from the benchmark for a given time period. Moreover, insiders can make trade decisions that result in a more profitable asset allocation because if they possess superior information.

Subsequently, this methodology corroborates the hypothesis that insiders possess privileged information and use it to decide the asset allocation.

7. Conclusions

The present study intended to assess the legal insider trading in Portugal. It is relevant to note that this study analyzed a greater database than previous studies in Portugal and used, for the first time in Portugal, portfolio management methodologies to study insider trading. Through the use of distinct methodologies, including the traditional event studies and performance measures of a portfolio that replicates the insider transactions in Portugal between 2008 and 2013, the overall conclusion attained indicates that insider transactions generate abnormal profits, inducing that they trade with inside information. As a consequence, the market does not appear to be efficient in the strong form.

In addition, outsiders can earn abnormal profits if they imitate insider transactions, since the time lag between the event and the disclosure is reduced and the abnormal returns persist long enough after the disclosure of transactions. As a result, outsiders can profit from the informational content of insider transaction disclosures.

Regarding the differences between activity sectors, the telecommunications, consumer goods and industrials sectors exhibit the greatest positive abnormal returns after purchases, while the oil and gas and the basic materials sectors reveal the greatest market reaction following sales.

The disclosure speed induces a differential in the cumulative abnormal returns verified, since the trades with disclosures within 5 working days from the transaction day have a greater market impact, suggesting that they contain more information or that outsiders attribute them greater importance than transactions with later disclosures.

The empirical findings achieved with performance measurement methodologies are less significant than the ones obtained with event studies. Nonetheless, they indicate the existence of inside information on the basis of insider transactions, being that insiders outperform the market.

Moreover, the division of the portfolio to assess the differences in performance between direct and indirect transactions as well as bank directors and ordinary insiders did not yield significant differences. Therefore, for the market and period in analysis, the indirect transactions do not appear to contain more privileged information than the

direct transactions and bank insiders do not have more information than ordinary insiders.

In order to assess the causes of the abnormal returns, a performance attribution analysis was conducted. In sum, this methodology enabled to conclude that abnormal profits are, in the most part, consequence of the allocation decisions made by insiders. This induces that insiders possess private information regarding the company and use it on their trades, achieving asset allocations more profitable than the benchmark.

In spite of the results attained, it must be reckoned that the period in study includes the financial crises and that, due to the crisis, financial markets typically exhibit unusual behaviors. This reality imposes a limit to the conclusion made, as they may be influenced by the crisis.

Other relevant limitation is the fact that in order to profit from insider transaction, outsiders may be require to perform short-selling strategies, which are limited in the Portuguese stock market.

Nevertheless, the empirical findings suggest that insiders earn abnormal profits and, subsequently, there is need for further legislation on this subject in Portugal, in order to bring the market closer to the strong form efficiency.

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9. Annexes

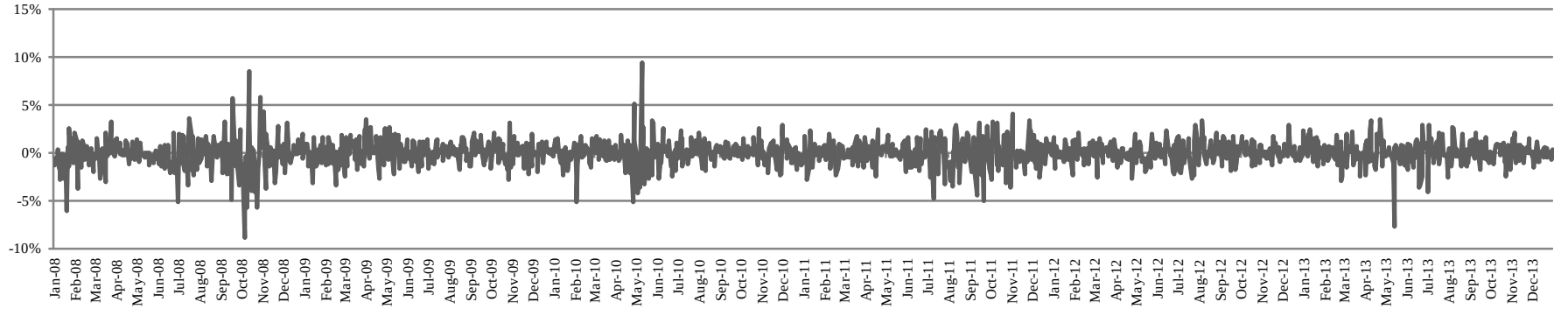
9.1. Annex A – Methodologies used in similar studies

This table illustrates the methodologies used by the authors mentioned in the insider trading literature review. The first column indicates the methodology and the second presents the authors who applied it.

Methodology	Author(s)
Event Studies	Jaffe (1974) Finnerty (1976) Baesel and Stein (1979) Seyhun (1986) Heinkel and Kraus (1987) Eckbo and Smith (1998) Del Brio *et al.* (2002) Friederich *et al.* (2002) Jeng *et al.* (2003) Fidrmuc *et al.* (2006) Aktas *et al.* (2008) Gonçalves and Duque (2008) Betzer and Theissen (2010) Corrêa (2012) Degryse *et al.* (2014)
Expected Rates of Return	Heinkel and Kraus (1987)
Grinblatt and Titman (1989)	Eckbo and Smith (1998)
Grinblatt and Titman (1993)	Eckbo and Smith (1998)
Jensen's Alpha	Eckbo and Smith (1998)
Rational Expectations Model	Leland (1992)
Net Purchase Ratio	Lakonishok and Lee (2001) Tavakoli *et al.* (2012)
CAPM	Jeng *et al.* (2003)
Characteristic-Selectivity Measure	Jeng *et al.* (2003)
Four-Factor Model	Jeng *et al.* (2003)

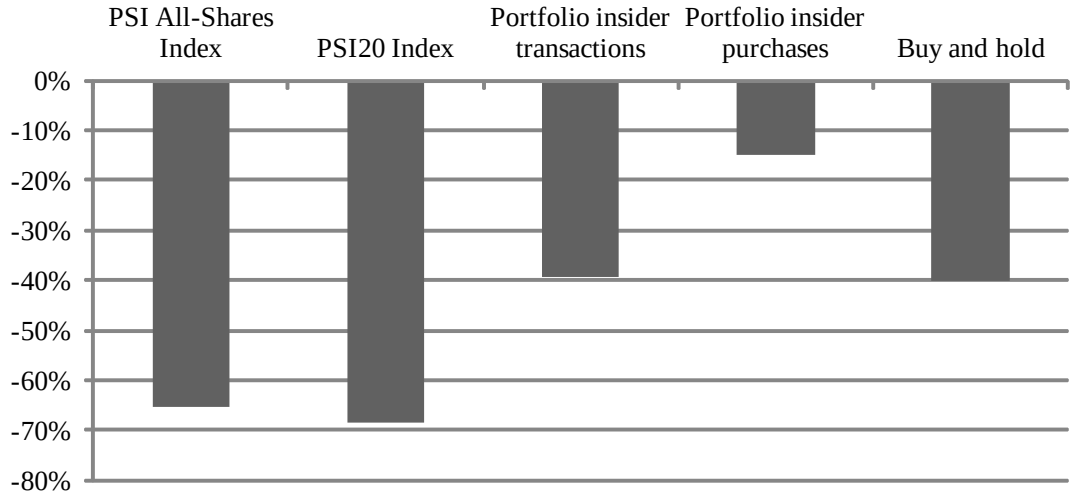
9.2. Annex B – Evolution of the returns attained by the portfolio of insider transactions

This graph illustrates the evolution of the returns obtained by the portfolio of insider transactions, between January 2008 and December 2013.



9.3. Annex C – Market, portfolios of insider transactions and purchases and buy and hold strategy returns

This graph details the returns obtained by the Portuguese market indexes, by a buy and hold strategy andby the portfolio of insider transactions and by the portfolio of insider purchases between 2008 and 2013.



9.4. Annex D – Performance attribution evolution

This graph reveals the evolution of the results obtained by the performance attribution analysis of the portfolio of insider transactions. The abbreviation AE, SE, IE and AR denote, respectively, Allocation Effect, Selection Effect, Interaction Effect and Active Return.